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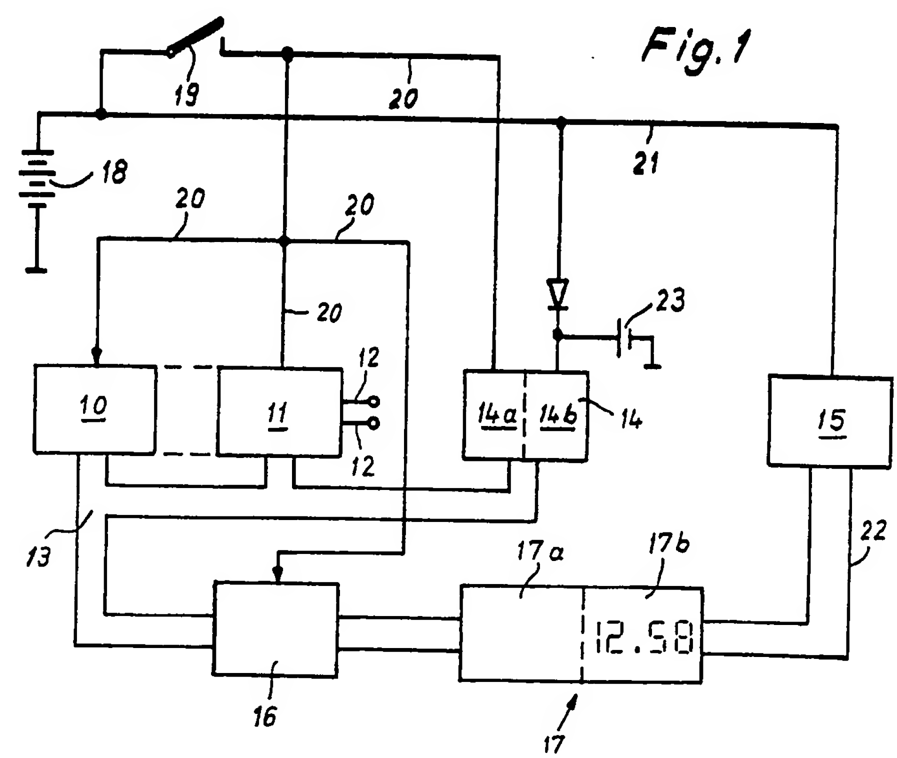
(54) Computer, especially for a motor vehicle

(57) In a computer, especially a board computer for a motor vehicle, the various switching stages, such as microcomputer (10), analogue-to-digital converter (11), memory (14) and clock module (15), are fed via different circuits of which one (20) may be switched off via an operating switch (19), while other circuits are permanently or at least temporarily connected to the battery (18). In this manner the current consumption of the entire system is reduced in dependence on the operating conditions.

Fig.1



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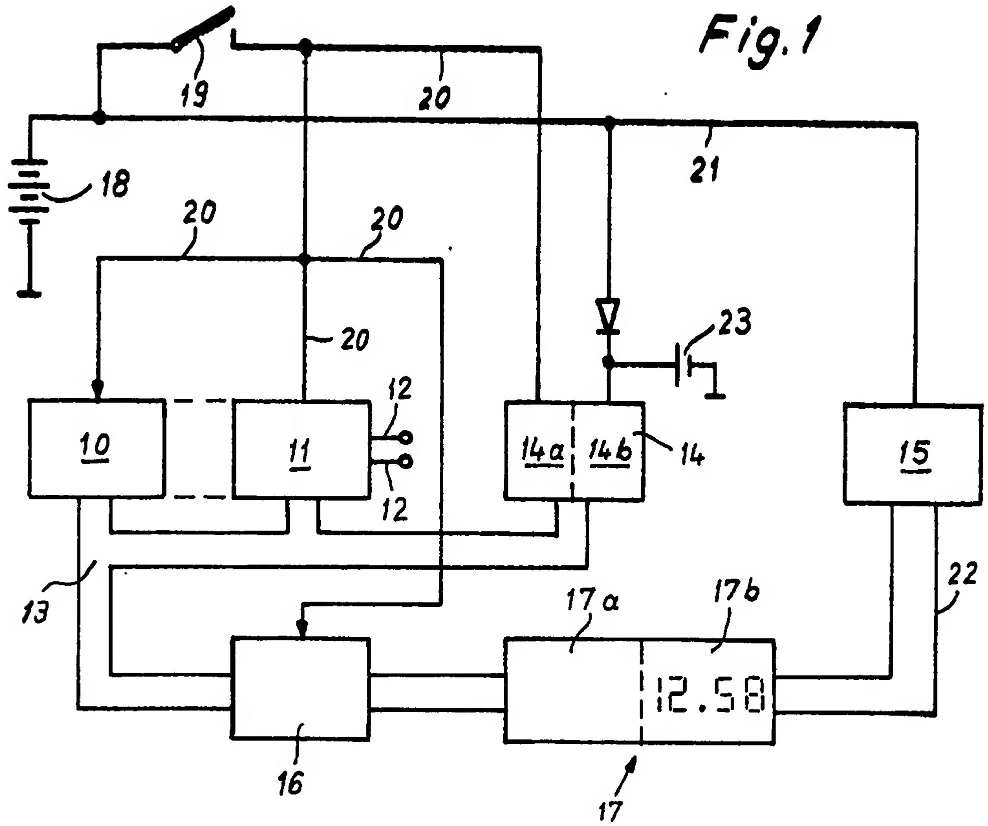


Fig. 1

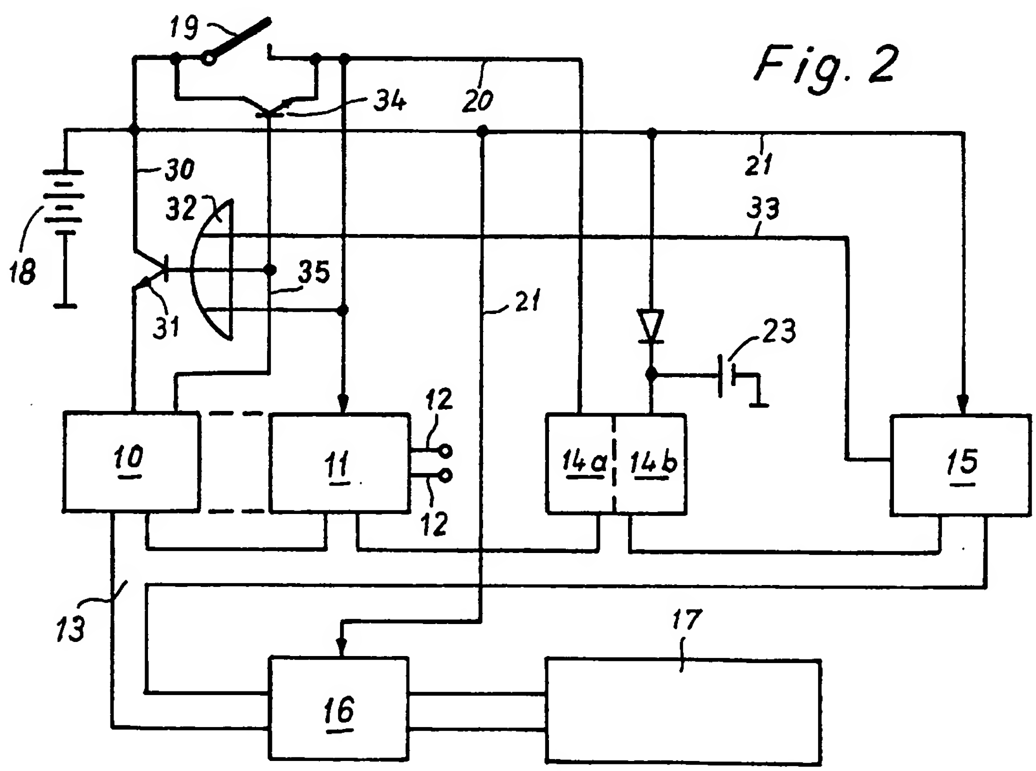
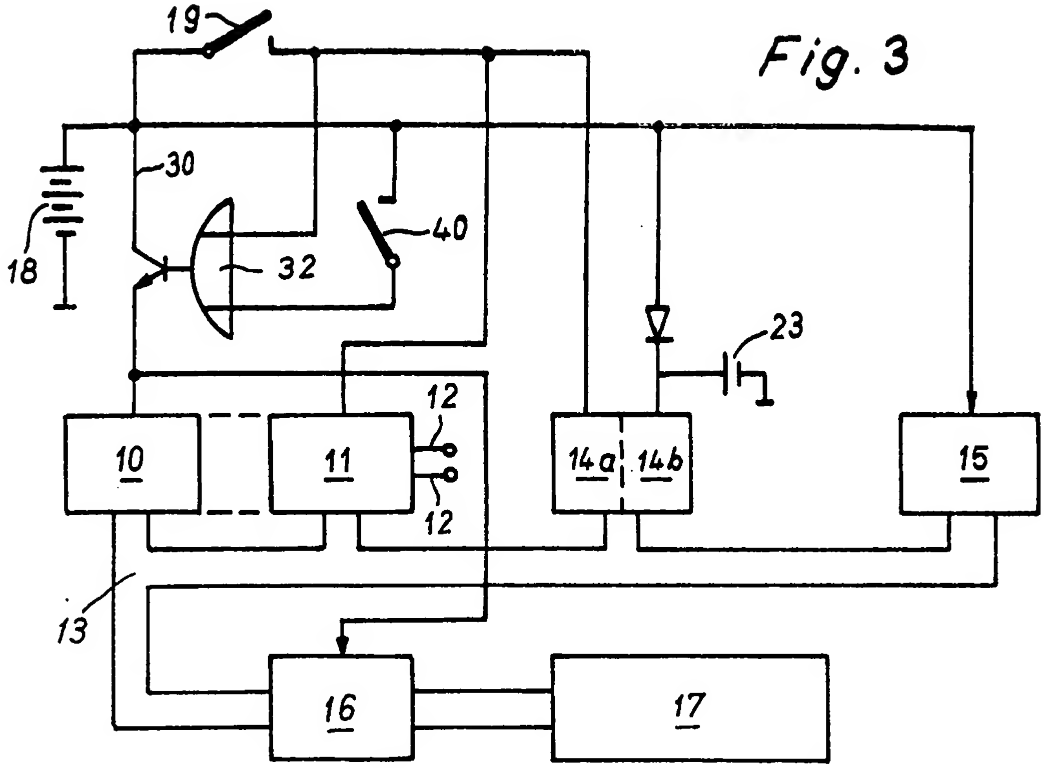


Fig. 2


19
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32
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18
23
12
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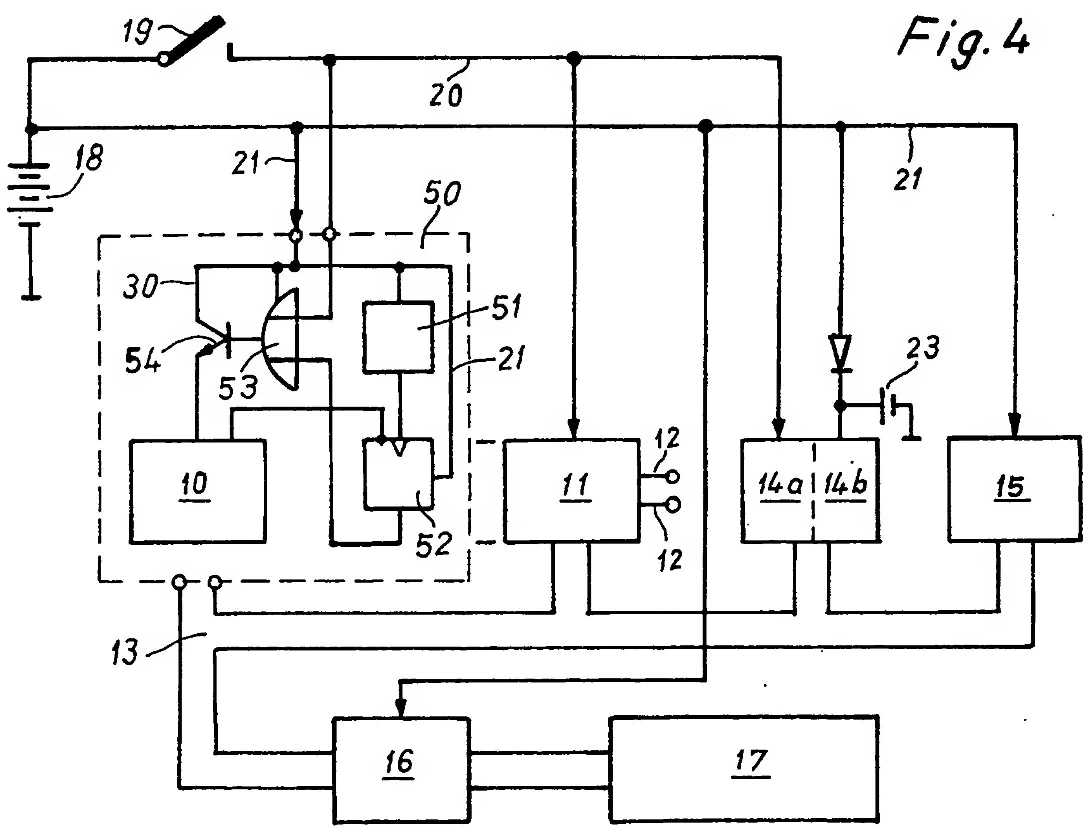
11
14a
14b
15
12
13
16
17

Fig. 3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21
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14a
14b
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52
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Fig. 4

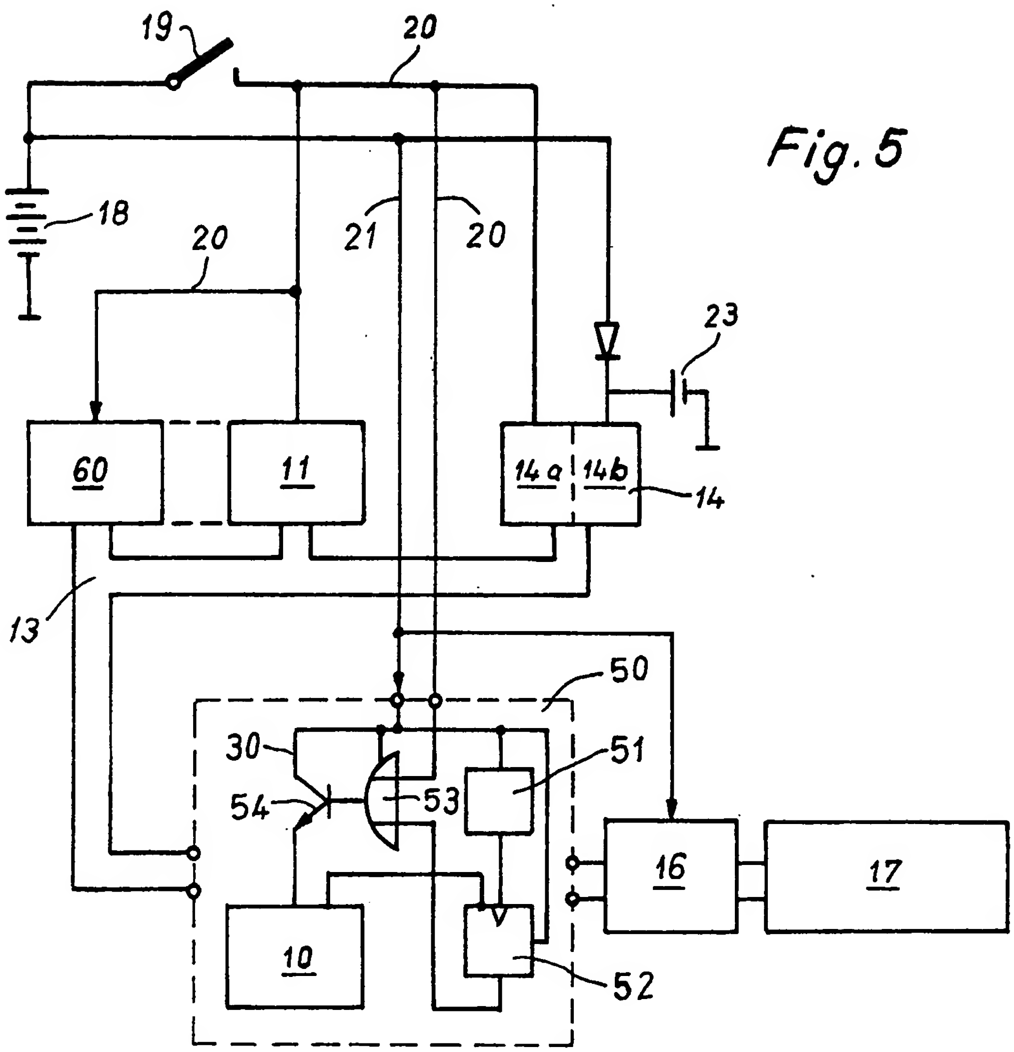

Fig. 5

SPECIFICATION

Computer, especially for a motor vehicle

This invention relates to a computer, especially a board computer for a motor vehicle of the kind comprising several electronic swtiching stages for processing signals, namely the actual microcomputer, the switching stages necessary for processing measured-value signals and the switching stages necessary for processing time signals, comprising a display device on which, in addition to the data derived from the measured-value signals, there can also be displayed a date, and comprising a current supply system with an operating switch for supplying these switching stages from a battery.

So-called board computers for motor vehicles are known, on a display device of which are shown in addition to certain measured values, such as the driving speed, the engine speed, the tank contents, a fuel consumption value, the cooling water temperature, among other things also time data, for example the hour of the data. Usually microcomputers or microprocessors are used in these board computers. As currently used, these microcomputers and microprocessors have a relatively high current consumption. Thus the current supply of computers of this kind is especially a problem, if they are supplied from the vehicle battery which is already heavily loaded, because it has to be considered that even when the operating switch (ignition switch) of the motor vehicle is switched off the board computer has to be continuously supplied with voltage, because certain values, for example the mileage reading, have to be stored and because the production of signals necessary for the time or the date must not be interrupted. Up to now the computer with all switching stages has directly been connected to the battery of the motor vehicle.

An object of the invention is to provide an improved computer of this kind which is arranged to reduce the current consumption at least temporarily.

According to the invention in its broadest aspect, a computer of the kind referred to is characterised in that the current supply system has at least two circuits whereby, via the first circuit, is supplied at least part of the switching stages exclusively necessary for processing the measured-value signals and whereby this circuit is switched off by a switching signal released by the operating switch in the off-position, whereas other switching stages are supplied through a second circuit which, also in the off-position of the operating switch, is at least temporarily connected to the battery.

The invention is thereby based on the understanding that not all the switching stages of a computer of this kind have to be connected to the voltage source at any time. Starting from this finding the invention is based on the consideration that the various switching stages should be supplied with voltage via separate circuits, whereby that circuit can be switched off via the operating switch through which the switching stages are fed which are exclusively necessary for processing measured-value signals. This already reduces the current consumption in practice considerably, so that it is prevented that the motor vehicle battery is inadmissibly discharged during standstill of the vehicle. Because the switching stages necessary for producing the time signals are supplied via another circuit which is permanently connected to the voltage source, the time can always be ascertained.

In a first embodiment of the invention the microcomputer and all other switching stages exclusively necessary for processing measured-value signals are supplied via the first circuit, the second circuit is permanently connected to the battery also in the off-position of the operating switch, this second circuit feeds a separate clock module and this clock module controls display elements of the display device, which display elements are electrically separated from the display elements for the measured values. This embodiment is thus based on the understanding that a circuit division can be effected especially easily in cases in which, on a single display device, different display elements are used for indication of measured-value data and time data; thus the time data are not connected to the display device via the actual microcomputer.

However the basic idea of the present invention can also be realised when — as in most cases — the same display elements of the display device are used for indication of measured-value data and time data and therefore also the time signals have to be conducted to the display device via the microcomputer. According to an advantageous embodiment of the invention it is suggested for embodiments of this kind that all switching stages exclusively necessary for the production of time signals are fed via a second circuit permanently connected to the battery and that the switching stages serving to process measured-value signals and time signals are fed via a third circuit, whereby with a switched-on operating switch, this third circuit is permanently connected to the voltage source, but with a switched-off operating switch, it is only temporarily connected. Here it is only essential that a computer of this kind has switching stages which, when the operating switch is switched-off, have only to be switched on when the time signals change. If thus, for example, the time has to be displayed only with exact minutes, it is sufficient to connect these switching stages to the battery for a given time interval every minute, so that the changing time signal can be received.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figures 1 to 5 show block diagrams of the various embodiments. These block diagrams are only intended to illustrate the principles of the essential features of the invention. For this purpose, in some embodiments, switching stages are shown which can be avoided in practice,

because the respective functions can also be realised by appropriate software.

The essential element of the computer according to the block diagram of Figure 1 is a microcomputer designated 10, which has an internal ROM and a RAM. Furthermore, an analogue-to-digital converter 11 can be integrated into this microcomputer. Measured-value signals are conducted to this converter 11, which can also be a separate module, via inputs 12. Moreover, input and output stages for acquisition or output of signals on the data bus 13 are part of the microcomputer.

In Figure 1 a switching stage for storing particular data is designated 14. This switching stage can comprise a non-volatile memory 14a or a volatile memory 14b. A socalled clock module is designated 15. This clock module has an internal clock generator and signals are supplied at the output of the former, from which information, for instance the time, can be derived. In most cases a switching stage 16 is needed to operate this computer, which switching stage converts the signals on the data bus 13 in such a way as to permit the display elements of a display device 17 to be controlled. Here, for example, a switching stage is concerned which increases the voltage level of the signals supplied by the microcomputer. In most cases the microcomputer indeed supplies signals with a voltage level of 5 or 0 volt, whereas voltage levels varying between 0 and 30 volt are necessary to control the display elements of certain types of displays, for example a LCD. Moreover the switching stage 16 supplies the necessary supply voltage for the display device 17.

The entire computer is supplied from a battery 18. The operating switch is designated 19, for example, the ignition switch of a motor vehicle.

In a system of this kind, the high current consumption of the actual microcomputer 10 offers a problem, because, in accordance with the prior art, the microcomputer is not produced in CMOS technology. The current consumption of a microcomputer of this kind lies in the order of magnitude of 50 mA. If the battery of a motor vehicle were loaded by a current of this order of magnitude for days without recharging the battery during automotive operation, one would have to expect that the motor vehicle engine can no longer be started. In order to prevent this disadvantage the current supply system of the circuit diagram according to Figure 1 has two independent circuits 20 and 21. The first circuit 20 may be switched off via the operating switch and feeds the switching stages which in the embodiment according to Figure 1 are exclusively necessary to process measured-value signals. These are the microcomputer 10, the analogue-to-digital converter 11 and the memory switching stage 14a as well as the switching stage 16 for feeding the display device 17. These switching stages are not needed, when the motor vehicle is at standstill. On the other hand the clock module 15 and, if required, the volatile memory switching stage 14b are controlled via the second circuit 21, which can be produced in CMOS technology and therefore pick up only a small amount of current. This second circuit 21 is permanently connected to the battery 18 of the vehicle. However this circuit division is only possible, when display elements of the display device 17 are controlled via the clock module 15, which display elements are electrically separated from the display elements for the measured values. This is shown symbolically in Figure 1 by dividing the display device into two partial areas 17a and 17b, whereby only the area 17b is used to display the time. Thus in this system the time signals are not fed into the data bus 13 which is part of the microcomputer 10. The time signals of the clock module 15 are, rather, directly conducted to the display elements in the area 17b of the display device 17 via a separate data bus 22.

Furthermore it is pointed out with regard to Figure 1 that, when a volatile memory stage 14b is used, a standby battery 23 is necessary in order to provide that particular data, for example the mileage reading, are retained, when the vehicle battery is switched off. Of course, it is not absolutely necessary that all switching stages which exclusively serve for the processing of measured-value signals are fed via the first circuit 20. A reduction of the current consumption is already achieved, when at least part of the switching stages exclusively necessary for processing measured-value signals are fed via the first circuit 20, which can be interrupted.

Figure 2 shows a circuit diagram for an embodiment, in which the measured values and the time data are indicated via the same display elements of the display device 17. Thus in contrast to the embodiment of Figure 1, the display elements for the measured values of this embodiment are not electrically separated from those for the time. The output signal of the clock module 15 is now conducted to the data bus 13 and picked up by the microcomputer 10. Then this microcomputer converts the signals so as to make them suitable to control the display elements in the display device 17 via the switching stage 16. In contrast to the embodiment according to Figure 1 the display elements of this embodiment not only serve for processing measured-value signals, but also for processing time signals. Therefore the microcomputer 10 of an embodiment of this kind is fed via a third circuit 30, into which a transistor 31 is inserted as a switching element. This transistor 31 is controlled via the OR-gate 32. The input of the OR-gate is controlled via the first circuit 20, so that the transistor 31 is conductive when the operating switch 19 is closed. When the operating switch 19 is switched on thus, this third circuit 30 is permanently conductive, so that measured-values can continuously be processed, when the motor vehicle is operated. Furthermore a lead 33 is controlled via the OR-gate 32, which lead is connected to one output of the clock module 15. At the output, to which the lead 33 is connected, the clock module 15 supplies

periodically a control signal for a given time interval. This control signal can for example be released, when the time changes by the smallest unit to be displayed. Thus the transistor 31, and thereby the third circuit 30, is temporarily closed and the microcomputer 10 is activated, also when the operating switch 19 is switched off. The microcomputer then picks up the output signals from the clock module 15. If one assumes that the switching stage 16, which via the second circuit 21 is permanently connected to the battery, comprises a memory, the time is permanently indicated on the display device 17, also when the operating switch 19 is switched off. This, as far as this embodiment is concerned, it can be stated that the switching stages 11 and 14a exclusively necessary for processing measured-value signals are fed via the first circuit 20, the switching stages 15 exclusively necessary for producing time signals via the second circuit 21 and the switching stages necessary for both purposes, processing of measured-value signals and processing of time signals, namely the microcomputer 10, are fed via a third circuit 30, whereby the first circuit 20 may be switched off via the operating switch 19, the second circuit 21 is permanently connected to the battery 18 and the third circuit 30, in dependence on the switching position of the operating switch, is either continuously or temporarily connected.

In Figure 2 a further transistor 34 is provided, whose switching path bridges the operating switch 19. This transistor 34 is controlled by an output signal of the microcomputer 10, which output signal is also conducted to a further input of the OR-gate 32. On the lead 35 of the output of the microcomputer a signal is generated as long as the microcomputer carries out a programme. If thus the third circuit 30 is closed and the microcomputer 10 is activated, via this lead 35 and the OR-gate 32 and the transistor 31 there is practically formed a selfholding circuit which is retained until the programme carried out by the microcomputer 10 is terminated. Only then is this third circuit 30 switched off again. At the same time it is ensured that the first circuit remains closed via the conductive transistor 34 until the programme is terminated. Furthermore it is thereby achieved that, when the operating switch is switched off, values can be written in the memory 14 also during a programme run. Thus in contrast to the embodiment according to Figure 1, in the embodiment according to Figure 2 the first circuit 20 is not immediately switched off together with the operating switch, but retardedly and indirectly via the microcomputer 10.

In the embodiment according to Figure 3, one input of the OR-gate 32 is connected to an arbitrarily actuable nonlocking switch 40. The switching signal of this nonlocking switch thus replaces the periodically released control signal of the clock module 15, which may be measured on the lead 33. When the operating switch 19 is switched off the time signal of this embodiment is thus only transferred into the microcomputer 10 upon actuation of this nonlocking switch 40 and conducted to the display device 17 via the switching stage 16. If, when the operating switch 19 is switched off, the nonlocking switch 40 is reset into the position shown in the drawing, the third circuit 30 is interrupted again and thus the microcomputer is switched off. Because also the switching stage 16 for supplying the display device 17 is fed via the third circuit 30 and, in contrast to the embodiment according to Figure 2, is not connected to the first circuit 20, this driver switching stage 16 and thus the display device 17 is also disconnected, when the nonlocking switch 40 is released.

In the embodiment according to Figure 4, a specific microcomputer module 50 is used. This module 50 has an internal clock generator 51, which releases a switching signal at its output at certain time intervals. This switching signal is conducted to a multivibrator 52, whose output is connected to the input of an OR-gate 53, which controls a transistor 54. The actual microcomputer with the switching stages necessary for carrying out the programme is fed via this transistor 54. The multivibrator 52 is reset via a signal of the microcomputer 10, when the programme is terminated. Thus this embodiment shows a circuit division for the microcomputer module 50. The clock generator 51, the multivibrator 52 and the OR-gate 53 are continuously fed via the second circuit 21, whereas the actual microcomputer 10 is fed via the third circuit 30 and the transistor 54. In the switching-on position of the operating switch 19, this third circuit is continuously closed. However in the off-position of the operating switch 19 this third circuit 30 is only closed, when the clock generator 51 releases a control signal and the multivibrator 52 is set. Then the microcomputer 10 carries out a programme and picks up the signals of the clock module 15. When the programme is terminated, the multivibrator is reset and thus the third circuit is interrupted again, so that the actual microcomputer is switched off. The microcomputer module 50 is thus activated by the internal clock generator at regular time intervals, so that the signals conducted to the display device 17 via the switching stage 16 can be actualised. In this embodiment one can also read the time on the display device 17 at any time.

In the embodiment according to Figure 4, it is assumed that the clock generator is, for example, a counter which supplies a control signal at periodic intervals. This control signal is then processed by the microcomputer 10, so that the control signals necessary for indicating the time and the date are released. However an embodiment can also be conceived in which, instead of this clock generator 51, a clock module is directly integrated in the microcomputer which delivers the necessary control signals for indicating the time. Thus the clock module 15 can be saved. Such a module is designated a single-chip microcomputer with integrated hardware clock.

In the embodiment according to Figure 5 two

microcomputer systems are used. A microcomputer module 50 according to Figure 4 only serves to produce the time signals and to control the switching stage 16 and the display device 17. Just as in Figure 4, this microcomputer module 50 is controlled via two circuits. The clock generator 51, the multivibrator 52 and the OR-gate 53 are fed via the second circuit 21, which is continuously applied to the battery. The actual microcomputer 10 is however again fed via the transistor 54, which is continuously conductive, when the operating switch 19 is switched on, and only temporarily conductive, when the time is to be actualised. A separate computer system comprising the microprocessor 60, the analogue-to-digital converter 11 and the memory switching stage 14 serves for the processing of measured-value signals. These switching stages exclusively necessary for processing of measured-value signals are all fed via the first circuit 20. The function of this system has to be imagined in a way that, when the operating switch 19 is switched on, the microcomputer module 50 picks up data on the data bus 13 from the microprocessor 60 which data are conducted to the display device 17 via the switching stage 16. On the other hand no signals are available on the data bus 13, when the operating switch 19 is switched off, and only the time data are indicated on the display device 17, which data are computed by the microcomputer module 50 on the basis of the signals of the clock generator 51.

On this occasion it has once again to be stressed that the switching function released by the clock generator 51, the multivibrator 52 and the OR-gate 53 in a microcomputer module 50 are generally realised by software in the case of modules produced in series. From a comparison between the circuit diagrams it can be seen that the switching stage 16, which is necessary for the indication of signals and not for actually processing signals, can be fed via various circuits. In the embodiment according to Figure 1, this switching stage 16 is fed via the first circuit 20, because the switching stage is only needed when measured values are to be indicated. In the embodiment according to Figure 2, the switching stage 16 is, in contrast thereto, continuously fed via the second circuit 21, because it is also needed for a continuous indication of time data. On the other hand, in the embodiment according to Figure 3, the switching stage 16 is fed via the third circuit 30. When the operating switch 19 is switched off, a switching signal on the display device is only shown for the time the nonlocking switch 40 is actuated. Thereby the current consumption of the entire system is further reduced, especially if one takes into consideration that, if required, an illumination unit for the display device can also be energised.

On the whole, in comparison with known versions, the current consumption is considerably reduced by an appropriate division of the current supply system into several circuits for feeding the various switching stages, so that a computer of this kind is particularly suitable to be employed in a motor vehicle. In these embodiments the current consumption from the vehicle battery is so low that it has not to be feared that the battery will be discharged, even if the vehicle is not operated for a longer period of time. In order to spare the battery furthermore it is suggested, in addition, to fit solar energy cells and/or thermocouples and to use the energy generated by these elements for feeding the circuits. The thermocouples will thereby be preferably attached on the engine and/or on the exhaust system, so that high differences in the temperature can be utilised. Large-area solar energy cells can be integrated into the engine hood, into the roof or into the luggage compartment cover. The energy generated by these elements can, for example, be utilised for feeding the volatile memory 14b; thus it can replace the standby battery 23 or at least can recharge it. Of course this energy could also be used for recharging the vehicle battery 18. In particular the energy of these elements could be used for the current supply of structural components whose reliable functioning is not absolutely necessary. This applies for example to the illumination of an instrument at standstill of the motor vehicle. A use of elements of this kind is especially advantageous, when the computer is also used to control a theft protection system, because this system cannot be made ineffective by switching off the main battery.

CLAIMS

1. A computer, especially a board computer for a motor vehicle, of the kind comprising several electronic switching stages for processing signals, namely the actual microcomputer, the switching stages necessary for processing measured-value signals and the switching stages necessary for processing time signals, comprising a display device on which, in addition to the data derived from the measured-value signals, there can also be displayed a date, and comprising a current supply system with an operating switch for supplying these switching stages from a battery, characterised in that the current supply system has at least two circuits (20, 21), whereby, via the first circuit (20) is supplied at least part of the switching stages (11, 14) exclusively necessary for processing the measured-value signals and whereby this circuit is switched off by a switching signal released by the operating switch (19) in the off-position, whereas other switching stages (15) are supplied through a second circuit (21) which, also in the off-position of the operating switch, is at least temporarily connected to the battery (18).

2. A computer according to claim 1, characterised in that the microcomputer (10) and all other switching stages (11, 14) exclusively necessary for processing measured-value signals are supplied via the first circuit (20), in that the second circuit (21) is permanently connected to the battery (18) also in the off-position of the operating switch (19), that this second circuit (21) feeds a separate clock module (15) and that this

clock module controls display elements of the display device (17), which display elements are electrically separated from the display elements for the measured values.

3. A computer according to claim 1, characterised in that the second circuit (21) is permanently connected to the battery (18) also in the off-position of the operating switch (19), that, via this second circuit (21), are fed the switching stages (15) exclusively necessary for producing the time signals and that switching stages (10) are fed via a third circuit (30), which switching stages serve for processing measured-value signals and for processing time signals, whereby this third circuit (30) is permanently connected to the battery (18), when the operating switch (19) is switched on and temporarily, when the operating switch (19) is switched off.

4. A computer according to claim 3, characterised in that the time signals are produced by a clock module supplied via the second circuit (21) and the microcomputer (10) is supplied via the third circuit (30), whereby in the off-position of the operation switch this third circuit (30) is periodically closed for a given time interval by a control signal obtained from the clock module(15).

5. A computer according to claim 3, characterised in that the time signals are produced by a clock module supplied via the second circuit (21) and the microcomputer is supplied via the third circuit (30), whereby in the off-position of the operating switch (19) this third circuit (30) can be closed by a nonlocking switch (40) which may be arbitrarily actuated.

6. A computer according to claim 3, characterised in that a microcomputer module (50) also serves to process the time signals, that this microcomputer module (50) internally comprises a clock generator (51), that this clock generator (51) is supplied via the second circuit (21) even with a switched-off operating switch (19) and that the switching stages of the microcomputer module (50) necessary for executing the programme are supplied via a third circuit (30), which for a given time interval is periodically closed by a control signal of the clock generator (51).

7. A computer according to claim 6, characterised in that the clock generator (51) periodically releases a control signal for connecting the third circuit (30) and that the microcomputer (10) of the microcomputer module (50) picks up the time signal of a clock module (15) permanently fed via the second circuit (21), when the third circuit (30) is closed.

8. A computer according to claim 6, characterised in that the clock generator (51) is a clock module integrated into the microcomputer module (50).

9. A computer according to any one of claims 6 to 8, characterised in that a separate microprocessor (60) serves to process the measured-value signals, which microprocessor is supplied via the first circuit (20), and that the data of this microprocessor (60) are conducted to the display device (17) via the microcomputer module (50).

10. A computer according to any one of the preceding claims, characterised in that, even with the operating switch (19) switched off, the first circuit (20) remains closed until it is interrupted by a switching signal released by the microcomputer (10), when the programme is terminated.

11. A computer according to any one of the preceding claims, characterised in that the protection of stored data is effected via a switching stage (14) comprising a non-volatile memory (14a) or via a switching stage comprising a volatile memory (14b), which is fed from a standby battery (23), and that the non-volatile memory (14a) is fed via the first circuit (20) and the volatile memory (14b) via the second circuit (21).

12. A computer according to any one of the preceding claims, characterised in that an analogue-to-digital converter is supplied via the first circuit (20).

13. A computer according to any one of the preceding claims, characterised in that a switching stage (16) for setting the level of the output signals of the microcomputer (10) and, if required, a memory and driver stage for the display elements of the display device (17), are supplied via a second or third circuit (21, 30), insofar as the same display elements of the display device (17) serve to indicate the time signals and the measured-value signals, whereas they are fed via the first circuit (20), if the time signals are supplied by a clock module (15) with driver stage and are shown on display elements electrically separated from the display elements for the measured values.

14. A computer, according to any one of the preceding claims, characterised in that the energy produced by solar energy cells and/or thermocouples is utilised for the current supply of various circuits, whereby the solar energy cells are integrated in the roof, the engine hood and the luggage compartment cover, whereas the thermocouples are preferably attached on the engine and/or on the exhaust system of the vehicle.

15. A computer according to claim 14, characterised in that various circuits are exclusively fed by the solar energy cells and/or the thermocouples and/or the battery of the vehicle and/or standby batteries are recharged by them.

16. A computer, especially for a motor vehicle substantially as described with reference to the accompanying drawings.

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